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A.D. 1840 . . . . N° 8716.

SPECIFICATION

OF

JUNIUS SMITH.

FURNACES.

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A.D. 1840 . . . . N° 8716.

Furnaces.

SMITH'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, Junius Smith, of Fen Court, Fenchurch Street, in the City of London, Gentleman, send greeting.

WHEREAS Her present most Excellent Majesty Queen Victoria, by Her Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Twenty-fifth day of November, in the fourth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Junius Smith, Her especial licence, full power, sole privilege and authority, that I, the said Junius Smith, my ex̃ors, adm̃ors, and assigns, or such others as I, the said Junius Smith, my ex̃ors, adm̃ors, or assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick upon Tweed, the Invention of "Certain Improvements in Furnaces," communicated to me by a certain foreigner residing abroad; in which said Letters Patent is contained a proviso that I, the said Junius Smith, shall cause a particular description of the nature of the said Invention, and in what manner the same is to be performed, to be enrolled in Her said Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said in part recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said Junius Smith, do hereby declare the nature of the said Invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following statement thereof, reference being had to the Drawing hereunto annexed, and to the figures and letters marked thereon, (that is to say) :—

These improvements consist in a mode of supplying heated atmospheric air to furnaces of every description by a new form of revolving blower, mounted in a double box or case, which blower draws in the fresh air through openings in the centres of the blower boxes, and forces the same by compression into the ash-pit, which is closed air-tight, the fresh air being commingled with and heated by the heat which would otherwise escape with the unconsumed combustible gases produced by the combustion of the fuel, which heat and gases are not allowed to escape by the chimney or flue in the ordinary way, but instead thereof are retained in a receptacle between the usual point of escape and the top or back of the blower box, and being received thence by the blower, are returned into the fire through the closed ash pit, the combustion of the fuel and these returned gases being maintained by the fresh air supplied through the centres of the blower boxes. The heavy and incombustible gases are allowed to descend by their own gravity into a receptacle in the outer box beneath the blower, where the general compression operates in aid of the gravity to force them through the interstices of a bed of sand, gravel, small pebbles, or any compound of similar substances that will offer and maintain a resistance to the internal pressure and yet allow these gases to escape by filtration into a chamber, whence they are taken away by a pipe or channel in any convenient direction. The form of blower intended to be generally used in these operations is equally and advantageously available for furnaces of any description, whether working so that the gases evolved by combustion escape into the atmosphere or not, and is herein-after described accordingly. By these combined operations the smoke and combustible cases are all or nearly all consumed; no smoke or sparks are given off, no heat escapes, no chimney is needed to produce the draft required for combustion, and a considerable saving of fuel is effected, as the heat and combustible gases which are lost in and through the common chimney are all used within the furnace and flues, and a complete protection is afforded against fire.

The mode of constructing and using the apparatus for producing these effects is now to be described, reference being had to the Drawings attached to and making part of this Specification, wherein Figure 1 is a plan, Figure 2 a vertical section of a common upright furnace, with this apparatus attached for use.

Figure 3 is a plan, and Figure 4 a vertical section, of a mode for fitting the apparatus to the furnace of a locomotive boiler, of which only the lower part of the fire chamber is shewn. Figure 5 is an end elevation, and Figure 6, a sectional elevation lengthwise, of a steamboat or stationary boiler with the apparatus attached. But it is not intended by these representations to limit or confine the mode or place for attaching the apparatus, as these must be varied according to the local circumstances of any particular boiler intended to be fitted therewith. The detached Figures are herein-after separately and consecutively referred to and explained, and each letter of reference used applies to the same parts in all the several Figures. A is a common vertical furnace or a boiler. B is the fire chamber. *a*, the fire bars. C, the ash pit, which is to be fitted and enclosed in all cases air tight with doors *b*. The fire doors *c* are made with an outer flat surface, shutting tight and close on a projecting flanch all round the opening, and the inner part or additional thickness of the door which goes within the opening is made less than the opening, so as to leave a small channel all round the opening for purposes hereafter explained. *d*, *d*, are the fire flues or tubes through the boiler. D is the connexion from the fire flues to the outer chamber of the blower E, which encloses the interior or blower chamber. *e*, *f*, are the bearings for the blower shaft *g*; and *h* is the blower made with arms h^1, formed either to carry common straight fans or fans set as in Figure 2, to force the air and gases through straight and parallel canals, or with fans set at a tangent to the centre air opening, or with curved fans. These two last forms are shewn in the Figure 4 and the detached Figure 10; but any other form of fan may be used that will answer the intended purpose, or a cylinder and piston blower, or any other blowing apparatus, may be used; but the form of blower herein described will generally be found preferable. In any form of rotary fans the ends of the fans are to be enclosed by the metal disk or plate rings *i*, *i*, to prevent any lateral escape, and thereby more effectually impel and compress the current of commingled heated air and returning gases, which are prevented from escaping out of the exterior case or chamber E by collar tubes *k*. These are open to the atmosphere, and project from the inner edges of the disc plates *i*, and their outer ends run, air-tight, in corresponding turned rings in the openings in the chamber E. These collar tubes are shewn on one side only in Figures 1 and 2, and on both sides in Figures 3 and 4. The heat and gases produced by combustion of the fuel are to be admitted into the blower by an opening in the blower box *e*, in any convenient manner. Three modes of doing this are shewn in the Drawings; the first, in the detached Figure 7, is applicable for use with a common fan blower, and represents a circular slot *l* in the side of the blower box *e*, which, when used, must be as near as possible at the point where the amount of pressure within the fans will be the same as the pressure of the heat and gases within the outer chamber E, and the quantity of the gases admitted is to be regulated by a sliding valve cover over the opening *l*, moved by a handle going through the outer box E.

The second mode of admitting and regulating the quantity of the entering gases is shewn in the detached Figure 9. In this the collar *k* is fixed in a neck on the exterior box, and does not revolve with the blower, as in the other modes described, and has, in any part, an opening *x* between the inner and outer boxes, that is to be more or less closed by a bent plate *y*, forming a circular slide or valve to regulate the quantity of the gases admitted.

The third mode is shewn in Figure 3, where a small stationary collar k^1 is shewn on one side as made conical, the smallest end inwards, within the running collar *k*, leaving a space *m* between the collar tube *k* and the inner edge of the disk or plate ring *i*, which will allow the entrance of the gases into the blower at the part where they will be forced in by the general internal pressure in the chamber E. The other collars may either be made to run the same, or be made tight as represented. The passage way *n* from the blower into the closed ash pit is shewn in Figure 2 as opening direct, and in Figures 3 and 4 as entering by a flat horizontal funnel or tube n^1, extending to the further end of the ash pit, and terminating in an opening n^2 on each side of the tube n^1. In Figures 5 and 6 the passage way from the blower to the ash pit is shewn as a descending flue. In Figure 4 the rib *o*, round the ash pit C, supports a plate *p*, between the fire bars and the entering blast of hot air and gas. This plate *p* is perforated full of small holes, and receiving the first pressure of the blast, disseminates it equally against and through the under part of the fire. In the bottom of the exterior box E is a box *v*, shewn separately in Figure 8, the top and bottom of which are formed by a wire or metal grating, and the space within is filled with small pebbles, fine gravel, coarse sand, or pummice stone pounded, or any similar compound that will, in quantity or texture, or both, offer a partial resistance to the internal, general, and equal pressure created by the action of the blower. The uncombustible gases generally from burning fuel, being specifically heavier than those which are combustible, will by their own gravity separate from the others, and in the first instance lodge on the bed of sand or gravel, where the compression created by the blower will operate in aid of their increased gravity to force such gases through the sand or gravel into the space beneath, whence they may be conveyed away in any convenient manner, as by the escape pipe *u*, shewn in Figure 2, or by the pipe *u*, Figures 5 and 6. In these last Figures the bed of sand or gravel *v* is shewn as under the exterior case E, and the pressure and filtration from within is upwards through the gravel or sand into the escape pipe *u*, as shewn in the detached Figure 11; but the gravel bed may be placed below the blower box *e*, and the hot gases carried behind and beneath the gravel, so that the lighter gases shall filter upwards into the inner box *e*, leaving the heavier and incombustible gases to go off through a second filtering bed v^1, as shewn in section in the detached Figure 12. In Figure 5 the fire doors *c* are shewn as of two thicknesses, as before noticed, the outer thickness fitting tight on a projecting flanch; the inner thickness does not quite fill the aperture, but closes against an inner frame, and leaves a channel all round the outer part. Into this are two or more small pipes z^1 from the descending flue *n*, and from this a small pipe z^2 leads down, and turns into the ash pit. This construction allows a portion of the heated air and gases to pass by the compression through the doors and into the fire, which produces the effect of keeping the inner part of the doors cool by abstracting the heat. This mode of construction is shewn in Figure 14. The exterior case E is not shewn in the Drawing as surrounded with a water jacket, but it is intended to fit such an addition to the apparatus, both for general safety and to form a heater from which the boiler may be supplied. In some situations the whole apparatus may be so arranged as to be contained entirely within the boiler, and thus save heat and fuel, prevent all smoke, sparks, and dust, and be an entire protection against fire. The general intent of these improvements, as thus far described, is to retain the heat within the fire flues under compression, and thus obtain a more perfect and equal distribution of the heat and ignition of the fuel, and to return the heat and gases into the fire through the closed ash pit, commingled with a supply of fresh atmospheric air, instead of the heat and gases being allowed to escape in the ordinary mode through the chimney. It is, however, not intended to limit the mode of using the apparatus to returning the heat and gases into the fire, as the apparatus may be so constructed as to allow of these escaping through the filtering bed, or the escape may be by a pipe and valve to regulate the pressure, or by a pipe with a diminished opening, going off by any convenient channel. But in practice these modes will not be so advantageous as returning the combustible gases through the blower, the operation of the blower remaining the same in producing an equal pressure within the fire way and flues, and by that a more perfect ignition of the fuel, as in either of these two last modes a considerable portion of the heat passing through the outer box E surrounding the blower will be communicated by the metal to the fresh air passing in, which will thus be supplied to the fire in a state producing the same effect as any other hot blast. Above the perforated plate *p*, Figure 4, is an apparatus for raking the fire bars, formed by two cross shafts *q*, carrying each two small cranks *r*. These support a small frame *s*, fitted with vertical teeth *t*, *t*, so spaced as to pass upwards between the grate bars *a*, and rake the fuel up by an alternating motion, given by a crank or any other competent means applied to one end of the cross shafts *q*, outside the furnace. In cases where a fuel feeder is required, it is intended to place a slide box where the fire doors are now usually placed, as shewn in Figure 13, where a^1 is the slide box, open at the inner end, and having a cover a^2 opening upwards against the boiler by hinges. This box encloses a tray a^3, made to fit close to the box a^1. At the furnace end a handle a^4 passes through the outer end of the box a^1. The cover a^2 being opened, the box is to be filled with fuel, and the cover closed. The box is to be purshed in and turned so as to empty the fuel over the fire as required. When a feeder is not used, it will be needful to interrupt the blast when the fuel is put in, and the Figures 1 and 2 shew a mode of doing this safely. *w* is a valve in the passage from the blower chamber to the ash pit on the outer end of the rod; carrying this valve is a small crank w^1, shewn by dotted lines, connected to a vertical rod w^2. In the connecting pipe D is a second valve w^8, connected by a crank w^9, shewn also by dotted lines, to the rod w^2. A hanging link w^3 connects the rod w^2 to the cross lever w^4. At the other end of this is a descending rod w^5, fitted with a shoulder to take the spring catch w^6, which is operated on by the fire door latch w^7. When the fire door is to be opened, the catch w^6 will be disengaged, the rod w^2 will descend by its own weight and close the lower valve *w*, at the same time dropping the valve w^8; this closes the pipe D, and opens the escape pipe above, giving vent to the smoke and gas, and interrupting the operation of the blower. When the fire is fed and the door is shut, the fireman draws down the rod w^5, and hitches it to the latch w^7; this opens the lower valve *w*, and rises the upper valve w^8, which opens the pipe D, and closes the escape pipe above; this retains the smoke and gas, and the operation of the blower recommences. Figure 15 is a plan, and Figure 16 a side sectional elevation, representing the mode of constructing the rotary blower for use in open furnaces without the exterior case E, the other references all remaining the same as in the preceding description, except that at 1 the joint between the collars *k* and the ring in the sides may be covered by a metal flanch if the blower is used with a hot blast, or by a leather flanch ring if used to drive a common cold blast; either of these will be useful to keep the joint air tight. This mode is applicable to any kind of open furnace, and will give an equal continuous blast, of considerable pressure, which may be varied by changing the speed at which the blower is driven, and will be in proportion to the size of the blower employed. In Figures 5 and 6, b^1 is a damper in the descending flue *n*; b^2 is a damper in the connecting pipe D; b^3 is a drum for driving the blower, by a belt from the engine; b^4 is a damper, to shut the common chimney when the apparatus is attached to a boiler already so fitted. This shuts off the common escape, and fits the boiler for receiving the apparatus. It is not intended by anything herein contained to limit the particular form or arrangement of any or all of the respective parts herein described, but to vary these, according to circumstances, in any way substantially the same, by which the whole or any part will be best adapted to the purposes intended, as herein set forth. What it is intended to claim as new is as follows:—

First, the mode of constructing revolving blowers for any purpose, with the ring plates on discs *i*, *i*, forming enclosures to prevent lateral escape of the air, as shewn in Figures 15 and 16; and the combination of such discs with fans, formed either as radiating from the centre in the common way, or with straight rectangular fans, such fans forming parallel canals for the passage of the air, as shown in Figures 2 and 16, or with curved fans, as shewn in Figure 4, or tangential fan, as shown in Figures 10 and 12; these two last modes forming canals larger at the periphery, where the air is forced outwards, than when it enters the blower; substantially as such constructions and combinations are described.

Second, the mode of admitting the atmosphere into the centre of the blower and preventing the escape of the air from the air chamber *e*, by the collars *k*, *k*, as shewn in Figures 15 and 16, whether the collars are fixtures to the blower case or made to revolve with the blower, having the outer ends to run in rings in the case of the blower, or with the two modes combined, as described, and the combination of such mode of admitting and preventing the escape of the air with the inclosed fans described in the first claim, whether the blower be used with a hot or cold blast, substantially as the same are represented and described herein.

Third, the mode herein described of supplying hot air to any furnace by surrounding the inner case of the blower with an exterior chamber E, into which the hot and unconsumed gaseous products of combustion from the fuel are to be received through the fire flues, to heat the air passing through the blower *e*, and combining with such outer chamber E an ash pit, tightly closed, through which the hot air blast is to be forced into and through the fire and flue ways, when such hot air blast is used with an open chimney, or with any common escape for the smoke and gas beyond the chamber E, substantially as the same are herein described.

Fourth, the mode herein described of obtaining compression within the fire and flue ways, and thereby creating a more effective ignition and action of the fuel and combustible gases within the flues, by interposing a bed of sand, gravel, pebbles, or any proper compound which will offer a partial resistance to and filter the compressed and escaping gases, such bed being between the fire and the common chimney or final escape of the gases, and such bed of any proper compound being used in combination with a blower within an exterior heated chamber, and forcing the fresh and heated air into a closed ash pit, and into and through the fire and flue ways, substantially as such mode and combination is herein described.

Fifth, the mode herein described of separating the heavy incombustible gaseous products of combustion from the lighter and combustible gases, by the direct gravity and the compression created by the blower in the flue ways and chamber E, acting downwards within the exterior chamber E of the blower *e*, shewn in the Figures 1, 2, 3, and 4, substantially as the same is represented and described.

Sixth, the mode herein described of separating the heavy and incombustible gaseous products of combustion from the lighter and combustible gases, by the change of temperature and their own gravity, and causing these heavy gases to accumulate in the lower part of the chamber E, whence the compression created by the blower forces them to filtrate upwards, and escape through the filtering bed, as shewn in the Figures 5, 6, and 11, substantially as the same are represented and described.

Seventh, the several modes herein described of separating the heavy incombustible products of combustion from the lighter and combustible gases, or any mode of obtaining compression, separation, and filtration of the gases, by the interposition of porous substances, which shall be substantially the same as any of the foregoing modes in the means employed or the effects produced.

Eighth, the modes described of admitting any portion of the hot and combustible gaseous products of combustion from the outer chamber E into the inner blower case *e*, at any point in the inner case *e*, where the hot gas will be forced into the blower box *e* by the general compression created by the blower within the chamber E, such hot gas being commingled with the fresh air in the blower, and forced into the fire, substantially as herein described; or any mode of admitting the hot and unconsumed combustible gaseous products of combustion into the blower case *e*, and commingling the same with the fresh air entering by the blower to support combustion, which shall be substantially the same as herein set forth in the means employed or the ends produced.

Ninth, the combination of a closed ash pit with the blower, and with all or any of the before-described means of obtaining compression, separation, and filtration of the gases evolved by combustion of the fuel, by the bed of sand or porous substances, or any compound that will produce the required effect, and the combination of these with the means described and claimed for forcing any portion of the unconsumed combustible gases into the blower, and commingling the same

FIG. 2.

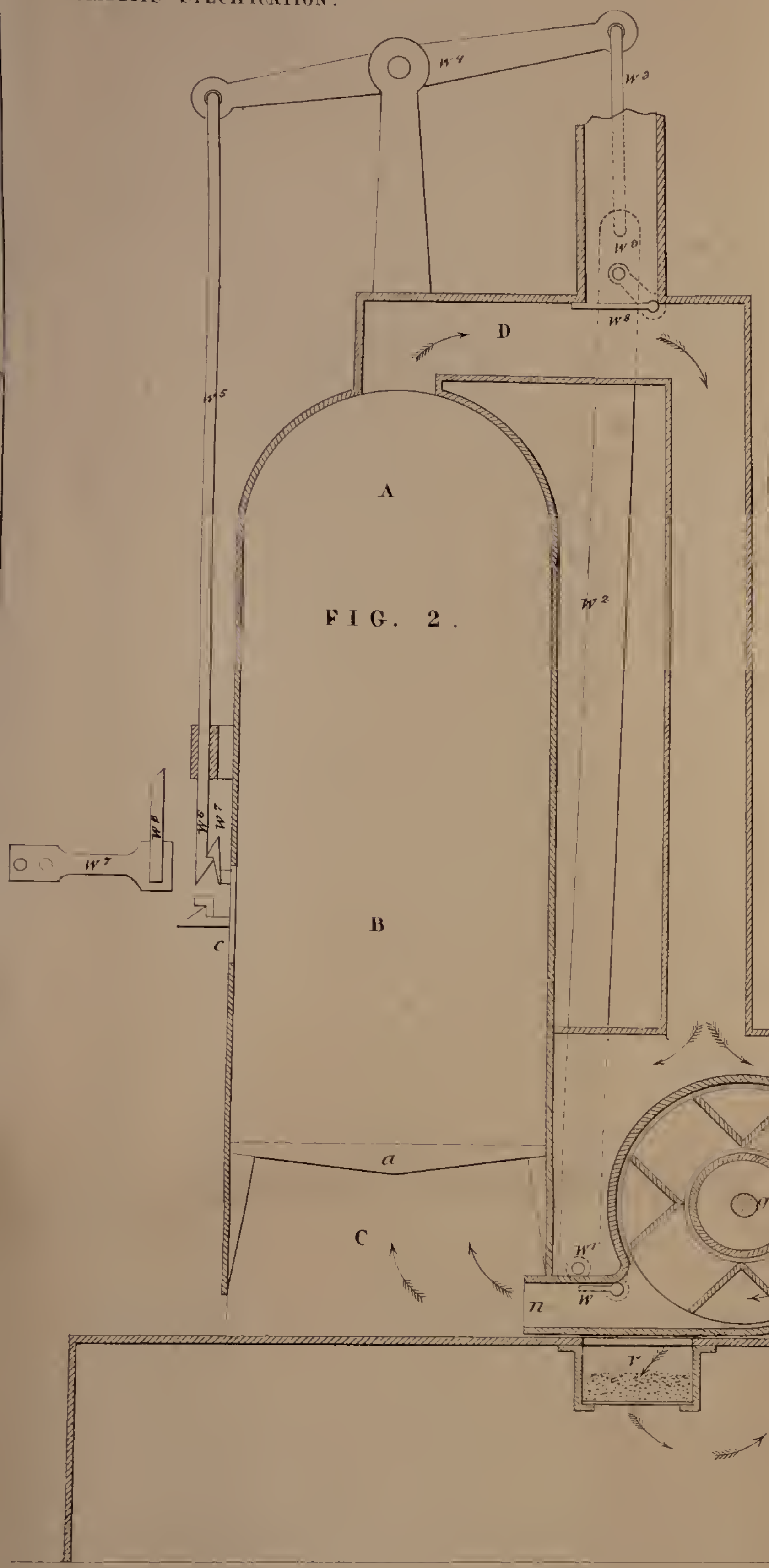


FIG. 10.

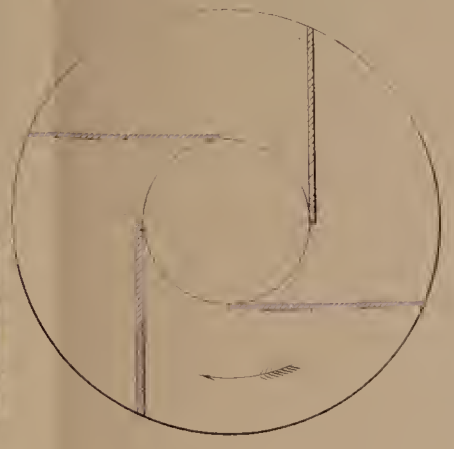


FIG. 4.

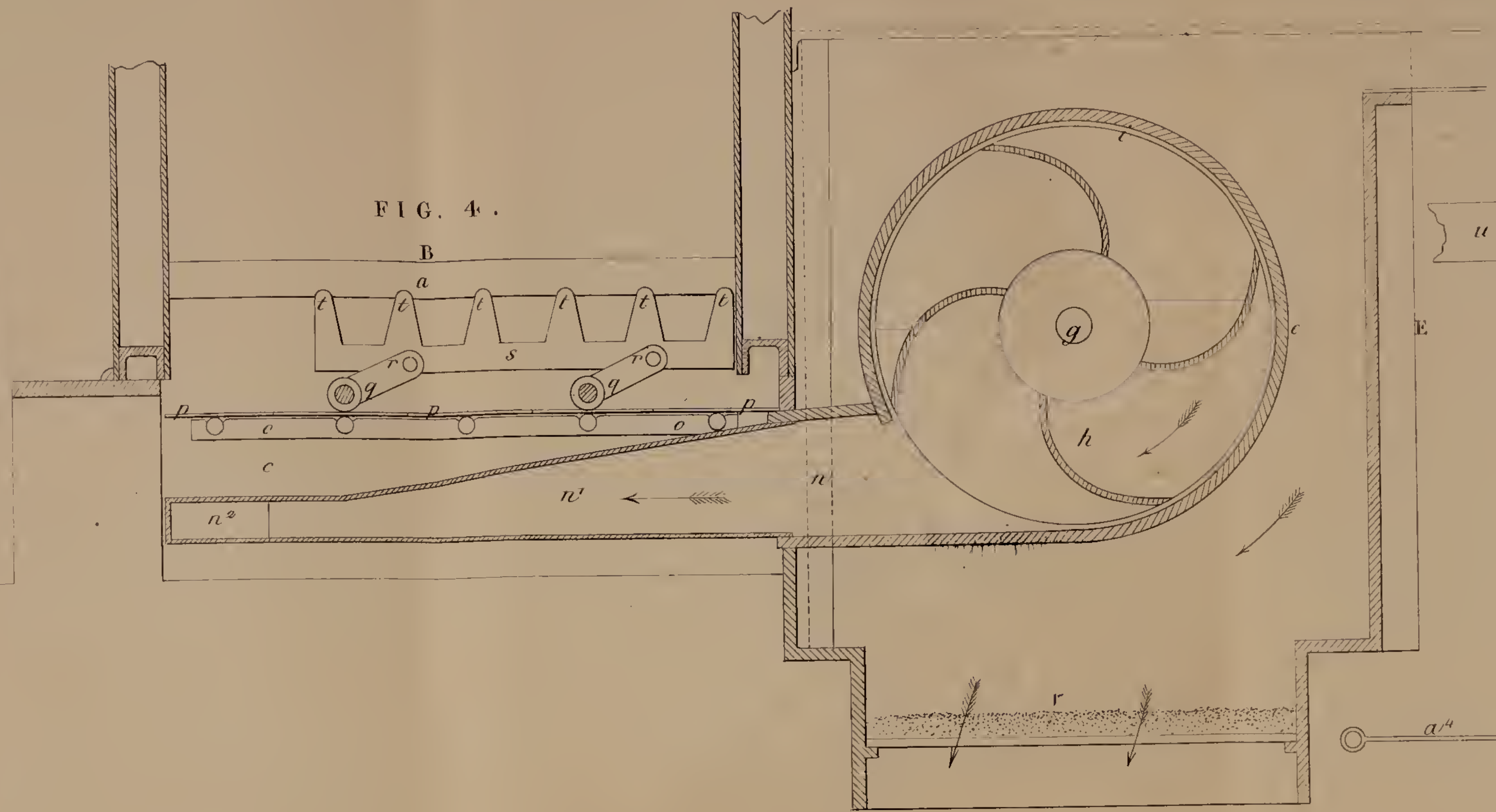


FIG. 6.

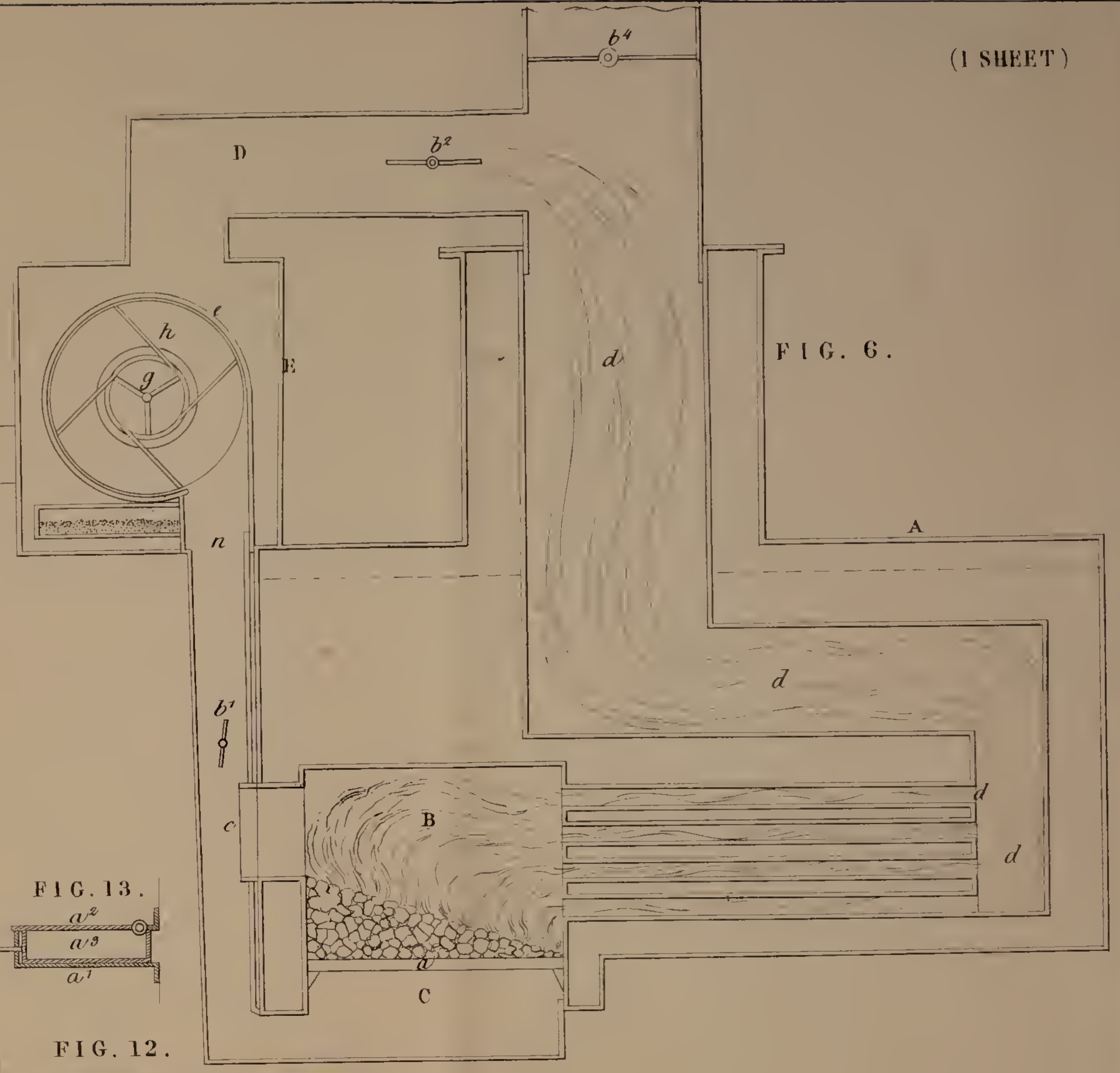


FIG. 13.

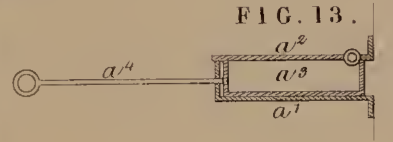


FIG. 12.

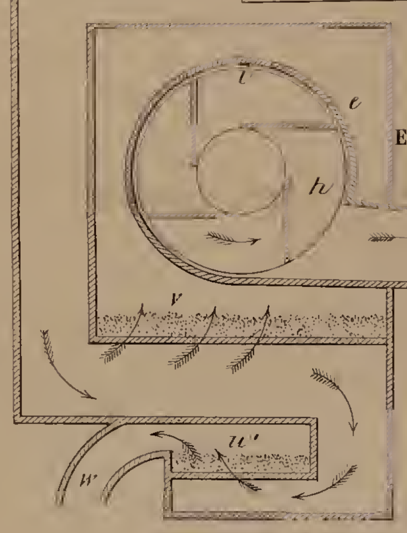


FIG. 8.

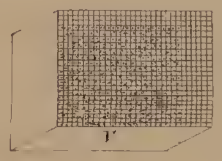


FIG. 3.

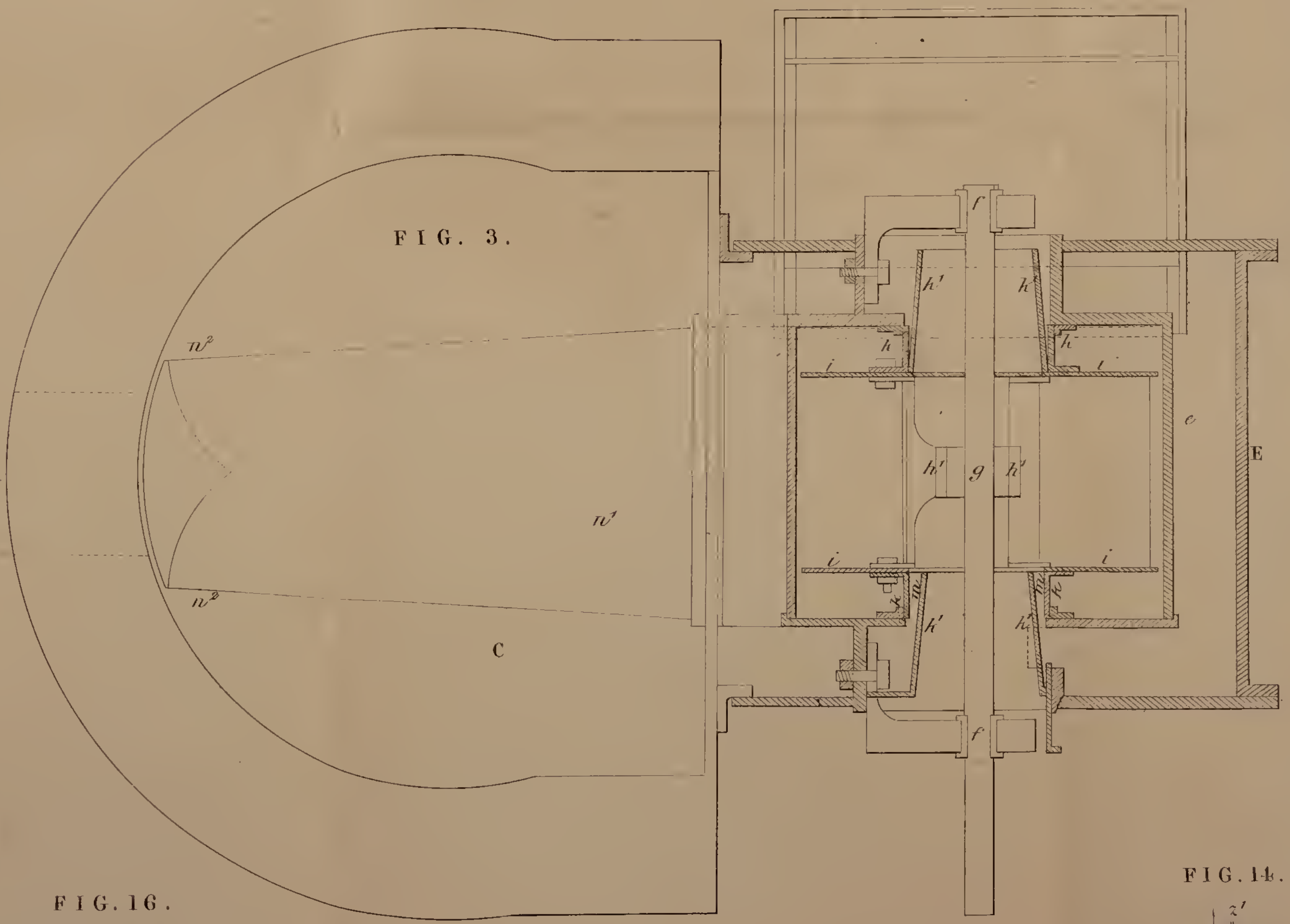


FIG. 11.

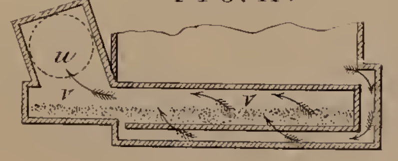


FIG. 5.

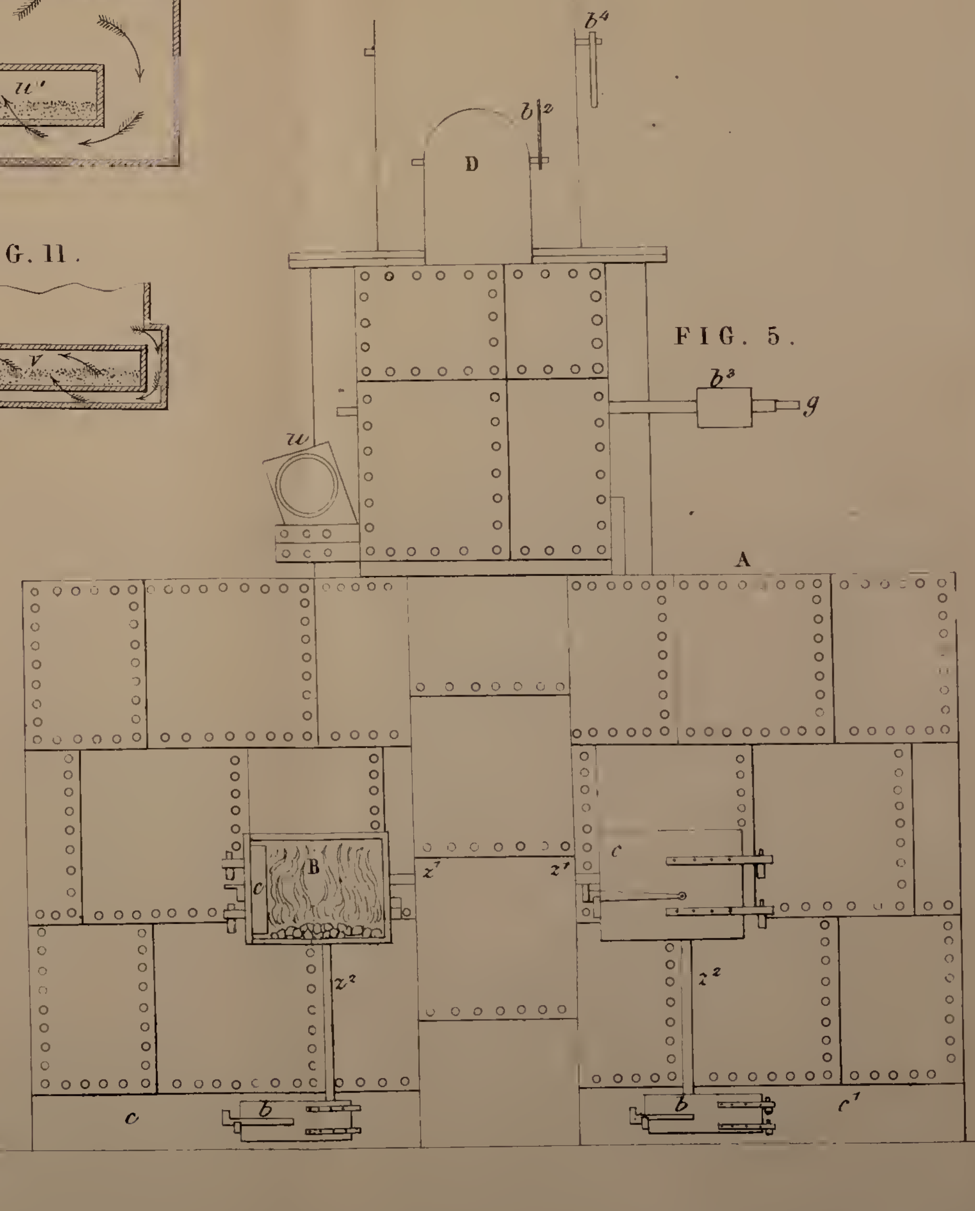


FIG. 9.

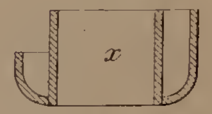


FIG. 7.

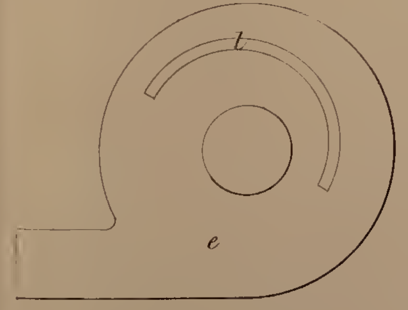


FIG. 1.

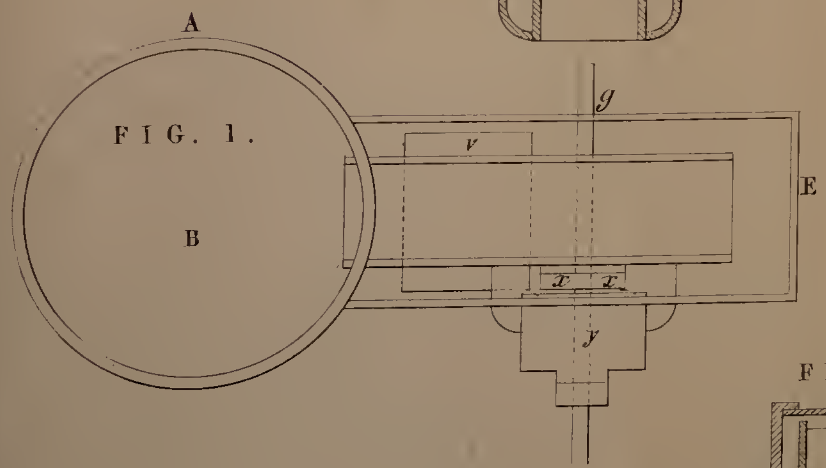


FIG. 15.

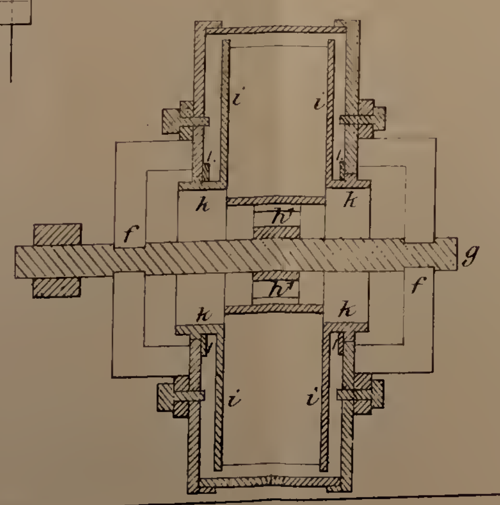


FIG. 16.

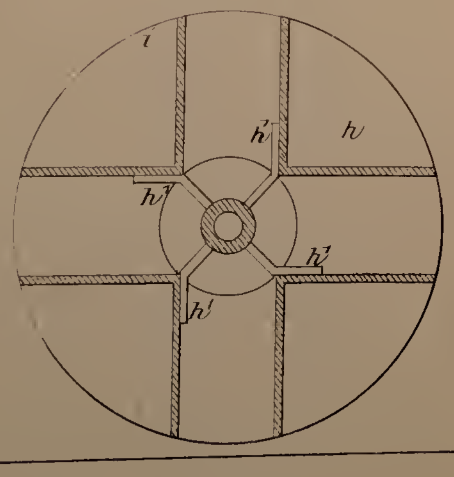
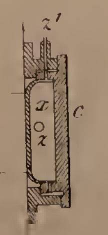


FIG. 14.



The Enrolled Drawing is partly colored.

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Printers to the Queen's most Excellent Majesty 1854.

J R Jobbins

with the fresh and heated air forced in by the blower to support the combustion of the fuel, substantially as such combinations are herein described and set forth.

Tenth, the mode of introducing the blast into the closed ash pit by the tube n^1, combined with the perforated plate p, to spread and distribute the blast equally under and through the fire, and the combination of these parts with the parts before described and claimed, substantially as the same are herein described.

Eleventh, the mode described of raking the fire bars by an alternating motion given to the shafts q, cranks r, frame s, and teeth t, t, as shewn in Figure 4, and the combination thereof with the other parts herein set forth, substantially as such mode and combination is herein described.

Twelfth, the mode described of feeding the fire with fuel by the slide box a^1, cover a^2 fuel tray a^3, and handle a^4, shewn in Figure 13, and the combination thereof with the other parts, substantially as such mode and combination are herein described.

Thirteenth, the mode of constructing and fitting the fire doors and frames tight, with an internal channel between the inner thickness of the doors and the frames, and a pipe or pipes z^1, entering from the blast pipe n, and a pipe or pipes z^2, passing from the lower part of the doors and frames into the closed ash pit, as shewn in Figures 5 and 14, to keep the doors cool by the circulation of the blast abstracting the heat from the inner thickness of the doors, and the combination of these parts with all or any of the other parts herein-before described, substantially as such mode of construction and combination is herein set forth.

Fourteenth, the surrounding the outer chamber E of the blower case with a water jacket, and applying such water jacket to serve as a heater of water to the boiler, in combination with the other parts herein described.

Fifteenth, the mode of interrupting the blast, to feed the fire at the doors, when a fuel feeder is not used, by the valves w and w^8, cranks w^1 and w^9, rods w^2 and w^5, link w^3, cross lever w^4, spring catch w^6, and latch w^7, as shewn in Figure 2, and the combination of these parts with the others, substantially as such mode and combination is herein described and set forth.

Sixteenth, the construction, arrangement, and combination of each and all the parts herein described with each other, where such construction, arrangement, and combination, all or any thereof, are applied to the purposes of economizing heat and saving fuel, substantially as the same are herein described.

In witness whereof, I, the said Junius Smith, have hereunto set my hand and seal, this Twenty-fifth day of May, in the year of our Lord One thousand eight hundred and forty-one.

JUNIUS (L.S.) SMITH.

Farrer.

AND BE IT REMEMBERED, that on the Twenty-fifth day of May, in the year of our Lord 1841, the aforesaid Junius Smith, Esquire, came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and everything therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Inrolled the Twenty-fifth day of May, in the year of our Lord One thousand eight hundred and forty-one.

LONDON:
Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1854.